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ROBOTICS AND THE INFANTRY SOLDIER: AN IMPROVED CAPABILITY IN THE 21ST CENTURY

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AIM

1. This paper is submitted for consideration by the Chief of Staff Land Strategic at the Canadian Army Headquarters. Warfare in the 21st century is being shaped by advancements in robotic technology that are increasing the fighting capability of the ground forces. This service paper will highlight the impact of these technological advancements in robotic warfare that the Canadian Army may consider pursuing in the next twenty years.

INTRODUCTION

2. For centuries now, military and government leaders have used engineers, scientists and academics to devise better tactical instruments to win strategic dominance over adversaries. Currently, countries like China, Russia, Great Britain and United States are believed to be working on technologically advanced robotic systems that can be configured to search and destroy enemy targets without human control. Though experts in military weapon-ology say that, autonomous weapons with a human operator as a fail safe are the answer to saving lives. They explain that the weapons will maintain some control by keeping troops out of danger and by using precision to avoid non-military deaths and other collateral damages. The future dominance in the use of robotic systems in warfare will solely depend on the rapid technological advancements that nations will be eager to pursue in the years ahead.

3. Technology is evolving exponentially and armies will need to analyze and adapt to the most recent technologies so as to stay ahead of their adversaries. Though evidently, armies in history have shown sluggishness to adjust innovations into universally accepted techniques, often at their peril. The most notable cases of omission to adjust to new technology were the effective innovation and deploying of rifled weapons, tanks and nuclear arsenals in the 1940s.¹

4. With such oversight, it is imperative that revolutionary militaries develop policy on the engagement of robots in the battlefield, especially due to the fact that there is an increase in robotic innovation. The United States Department of Defence (DoD) Unmanned Systems Roadmap 2007-2032 shows the Army's outlined ground robot system capability set that is moving towards the robotic squad member concept.²

DISCUSSION

¹ Michael Kolb "*Soldier and Robot Interaction in Combat Environments*." (Pro Quest Dissertations Publishing, 2012),5.

² USA DoD –unmanned systems-roadmap_2007-2032. <https://www.amazon.ca/Unmanned-Systems-Roadmap-2007-2032-Black/dp/1505936977>.

5. In the 2003 Iraq invasion, the U.S. Army did not employ robotic technology, but as casualties began to rise, ground robots started being introduced into the theatre. These robot systems had little Artificial Intelligence (AI) and were principally remote controlled by ground troops; they were mainly used for the detection of Improvised Explosive Devices (IEDs) and reconnaissance of the air. Due to their success, more systems of robots were directed into battlefield and the present generation has showed remarkable improvement in AI and autonomy.³The U.S. Army identified the capabilities of unmanned ground vehicles to influence the battlefield and reduce the number of casualties. The following discussions will outline such capabilities and how they would impact on the future function of the Canadian infanteer.

6. The Canadian infanteer must prepare for combat in an ever changing battlefield environment that will be intense and fought in quite asymmetric ways. For the infanteer to adapt to the threat, evolving a doctrine that relates well with the employment of robotic systems must be developed as a basis for future force development and success. Any modern force that wishes to develop and take advantage of the technological advancement has to marry the combination of new innovations and untested doctrine to ascertain the right structures, weapons and tactics for the soldiers. When this is well coordinated and networked, the 21st century infanteer capabilities on the battlefield will be multiplied and unmatched.⁴

7. The infantry section is the smallest unit in land operations on the battlefield capable of carrying out tactical operations dismounted. Its composition is solely based on the role, mission and tasks that it is given. The infanteer's extant role is to close with the enemy and destroy him across the full spectrum of the battlefield by manoeuvre and seizure of an objective by holding ground. For the infanteer to be combat effective, he must be self-sustaining, able to survive, manoeuvre and have the required fire power with him. With a future security environment that will be uncertain and probably call for adaptive dispersed operations (ADO), an infantry section must be organized with robotic systems that are interoperable and sufficiently capable to carry out these tasks.⁵ Technology is bringing with it enhanced mobility, firepower and protection for the ground soldiers. The succeeding paragraphs will outline a number of features that will be enhanced by the robotic systems to increase the capabilities of an infanteer in the 21st century.

8. The tactical agility of the infanteer would be enhanced by the introduction of an ergonomic designed suit that will have an integrated, modular, tailored combat ensemble and helmet with a sensor fusion for improved performance. The infantry section would be equipped with the right type of weapons for the right tasks and be able to move lightly and swiftly supported by the integrated robotic system and future fighting vehicles (FFVs). This will allow the infanteer to operate effectively in close terrain and close combat.⁶ The twenty first century infanteer would have an embedded training system, to make him mission ready at all times, be equipped with tools to manage and synchronize combat power and joint fires and he would be system networked for Situational Awareness (SA). For the future infanteer to own the fight on

³ Michael Kolb, "*Soldier and Robot Interaction in Combat Environments*" (Pro Quest Dissertations Publishing, 2012),2.

⁴ V. Satter and M. O'Leary, "*Organizing Modern Infantry: An Analysis of the section fighting power*", (The Canadian Army Journal Vol 13.3 2010), 45.

⁵ *Ibid.*, 48

⁶ V. Satter and M. O'Leary, "*Organizing Modern Infantry: An Analysis of the section fighting power*", (The Canadian Army Journal Vol 13.3 2010),41.

the battlefield, he will need to be interfaced with the robotic systems and future combat vehicles for increased lethality and coordination which will be enhanced by SA, Intelligence, Surveillance and Reconnaissance (ISR) and tactical maneuver. The question of command of the system platforms will not arise because the infanteer will have the capability to be in control and command the systems thus remaining in the loop.⁷

9. Protection and tactical mobility in close battle for the ground soldier lies in his or her ability to move lightly, quickly and stealthy whilst receiving suppressive fire from supporting elements on the battlefield. The aspects of soldiers' maneuverability would be easily enhanced due to the carriage of lighter loads that will in turn increase a soldiers' speed on the battlefield and precision targeting which will be achieved through well networked system platforms. Effective suppressive fire will be brought onto the battlefield by the use of robotic platforms like the Multifunction Utility or Logistics and Equipment (MULE) system. This platform would do anything from carrying various stores and supplies for ground forces to setting its own arsenals, such as machine guns and rockets.⁸This system will be able to carry loads of cargo and ammunition for the ground soldiers thus increasing their protection and mobility.

10. Operational Mobility in the battlefield will be enhanced by the FFVs that will be modularly designed and configured to network with the ground soldier. The maneuver that these vehicles will bring to the battlefield is an additional integration to the infanteer. The system platforms will be able to move men and material to the decisive points of the battle.

11. Lethality for the infanteer in the 21st century will need to be enhanced. The contemporary soldier system lacks integrated SA, information sharing and navigational aids for complex terrain.⁹The dismounted infanteer lacks the ability to harness information-age technology to effect better command execution, target acquisition and SA at a lowest level. The infanteer also lacks connectivity for precise effects-based weapon engagement. The future soldier weapon system would provide unmatched lethality and versatility of the infanteer on the battlefield in that a robotic system will allow direct and indirect target engagements, while effecting decisively required aggressive and suppressive target effects at longer range and against hidden targets.

12. As highlighted in the previous paragraphs, the dawn of the golden age of robotic warfare is upon us. In the Global War on Terror, before the U.S. Armed Forces introduced the robotic platforms in Iraq and Afghanistan, the forces had suffered casualties that one would not have imagined. The asymmetric battlefield that evolved in which the forces faced non-traditional combatant forces that operated and took sanctuary in complex terrains such as mountains and caves left no option for the U.S. forces but to resort to innovative robotic platforms.

13. The PackBot which is a series of military robots by iRobot, the Special Weapons and Observation Reconnaissance Detection System (SWORDS), and Talon, a lightweight unmanned and tracked military robot were the only few of the many unmanned ground vehicles (UGVs)

⁷ Nile L.Clifton and Douglas W. Copeland "The Land Warrior Soldier system: a case study for the acquisition of soldier systems." (2008),186.

⁸ P. W. Singer, "Wired for War" *The Robotics Revolution and Conflict in the Twenty-First Century* (New York: Penguin Press, 2009), 32.

⁹ Key ADO Capability Deficiencies of the Contemporary Soldier System: *Integrated Soldier System Project*. Director Land Requirements, Department of National Defence ,2009.

that were operating in war years back. When the U.S. invaded Iraq in 2003, they initially had no robots in the battlefield and experienced a great number of human casualties. The number of robots rose up to 150 by the end of 2004 and by the end of 2005, it was about 2,400. The projection of the numbers was that it had to reach the 12,000 mark by the year 2008. The robotic platforms that were in Iraq came in a number of different designs. Of all the robotic systems, the one that was used most was the MARCBOT (Multi-Function Agile Remote- Controlled Robot), used for enemy scouting and searching for hidden explosives.¹⁰The early motivation to employ the robotic systems was the desire for them to take up tasks performed by the ground troops that were deemed to fall in the three Ds; “dull” (consisting of long duration tasks or operations of a repetitive nature), “dirty”(comprising of combat tasks carried out in areas that were contaminated), or “dangerous” (consisting of operations which were viewed so dangerous to combat troops and manned platforms), such as mine clearing, disposal of explosive ordnance and strikes against combat networks by employing precision guided missiles.¹¹

14. The latest robotic systems are more efficient, smart, and independent than those employed in the Afghanistan and Iraq war. The first versions of the PackBots have been enhanced from just having cameras to one that is performing Explosive Ordnance Disposal (EOD) tasks and is at the same time armed for battlefield roles. The SWORDS system is earmarked for replacement by a Modular Advanced Armed Robotic System (MAARS) that has a machine gun with a bigger caliber, a 40mm grenade launcher, a nonlethal setting of a green laser dazzler and is equipped with tear gas. Another version that has been introduced is a robot equipped with laser and sound detection equipment that can locate a sniper in the process of targeting. When the target is spotted, it instantly engages it with the infrared laser beams. This robot is called Robot Enhanced Detection Outpost with Laser (REDOWL). All these advancements are meant to give advantage to the ground forces that are the fighting force of tomorrow.

15. Adaptive dispersed operations will require movement and generation of effects across the moral, physical and information planes of the battlefield in order to place land forces at decisive points. Lieutenant General P. J Devlin states in his foreword to *Designing Canada’s Army of Tomorrow* that “To remain an effective instrument of national power the Canadian Army must continue to innovate and adapt. Land Operations 2021, Adaptive Dispersed Operations: The Force Employment Concept for Canada’s Army of Tomorrow provides the overarching framework for how the Army will successfully operate in the future operating environment”.¹²For full spectrum engagement (FSE) to be effective, a networked soldier, the family of the future combat vehicles and integrated effects will need to be at play.

16. A combination of an improved infanteer capability networking with the robotic and combat vehicle system platforms will prove a force that will be balanced and able to carry out tasks that are beyond that is possible today. The Army operational functions of Command, Act, Shield, Sense and Sustain will still be the framework on which the infanteer will operate. Command of these entities will be based on a human centric framework; the ground soldier will

¹⁰ P. W. Singer, “*Wired for War*” *The Robotics Revolution and Conflict in the Twenty-First Century* (New York: Penguin Press, 2009), 32.

¹¹ *Ibid.*, 63.

¹² *Designing Canada’s Army of Tomorrow: The Canadian Army Advancing towards Land Operations 2021*(National Defence and the Canadian Forces, 2011), 3.

remain in command and operational capabilities will improve with more shared SA. This will help commanders to make decisions based on shared and amplified information in quicker time than before. The functions of Sense and Act will evolve most powerfully due to the enhanced capabilities of robotic and combat vehicle platforms. The shield function will be managed by both the soldier and the system platforms and the machines will additionally be able to provide the protection needed for their survivability. Since humans will be less present in the battlefield, the provision of sustainment support will become less of a requirement.

CONCLUSION

17. Robotic systems are likely to be exploited by modern armies and will expand into more autonomous platforms in the next 20 years. That is particularly true given that a number of countries, most notably China and Russia now have the potential to compete with western nations in military innovation.¹³ Robotic systems simply hold huge advantages—from saving the lives of our own troops, to safely defusing bombs and IEDs, to operating in remotely and treacherous environments such as mountainside caves. Robotic warfare will unquestionably shape the capability of an infanteer and the Canadian Army (CA) must embrace robotics or be left behind.

RECOMMENDATION

18. The CA should look at the following in the 21st century:
- a. The CA should consider integrating robotic platforms with the regular infanteer at the earliest and leverage advancing technology to enable the systems to effectively execute operational functions in a more modular way.
 - b. The Land Forces Doctrine should be generated to cover all aspects of near-future integrated robotic operations and interoperability.
 - c. The CA should prioritize the scaling down and equipping of the infantry units to meet future challenges in warfare.

¹³ Daniel McGlynn "Robotic Warfare" *CQ Researcher* 25, no. 4 (January 23, 2015): 73-96. <http://library.cqpress.com/cqresearcher/cqresrr2015012314>.

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